FOURTH QUARTERLY AMBIENT AIR MONITORING REPORT LIVINGSTON RAIL YARD

ENVIROCON, INC.

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

STAN STEPHENS, GOVERNOR

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Helena, MT 59620

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Superfund Section
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November 27, 1991

Harold Chambers
Montana State Library
Capitol Complex
Helena, MT 59620

Dear Mr. Chambers:

Enclosed is a copy of the Fourth Quarterly Ambient Air Monitoring Report for the BN Livingston Site.

After review of this report and the 3 previous reports, MDHES will determine if enough data has been collected to discontinue ambient air monitoring at the site.

Please call if you have any questions.

Sincerely,

John H. Wadhams

John H. Wadhams
Project Coordinator
BN Livingston Site

Enclosure

JHW/gme

FOURTH QUARTERLY
AMBIENT AIR MONITORING REPORT
LIVINGSTON RAIL YARD

Submitted to:

Montana Department of Health
and Environmental Sciences
Cogswell Building
Helena, Montana 59620

Submitted by:

Burlington Northern Railroad Co.
9401 Indian Creek Parkway
Overland Park, Kansas 66201

Prepared by:

Envirocon, Inc.
P.O. Box 8243
Missoula, Montana 59807

Submittal date:

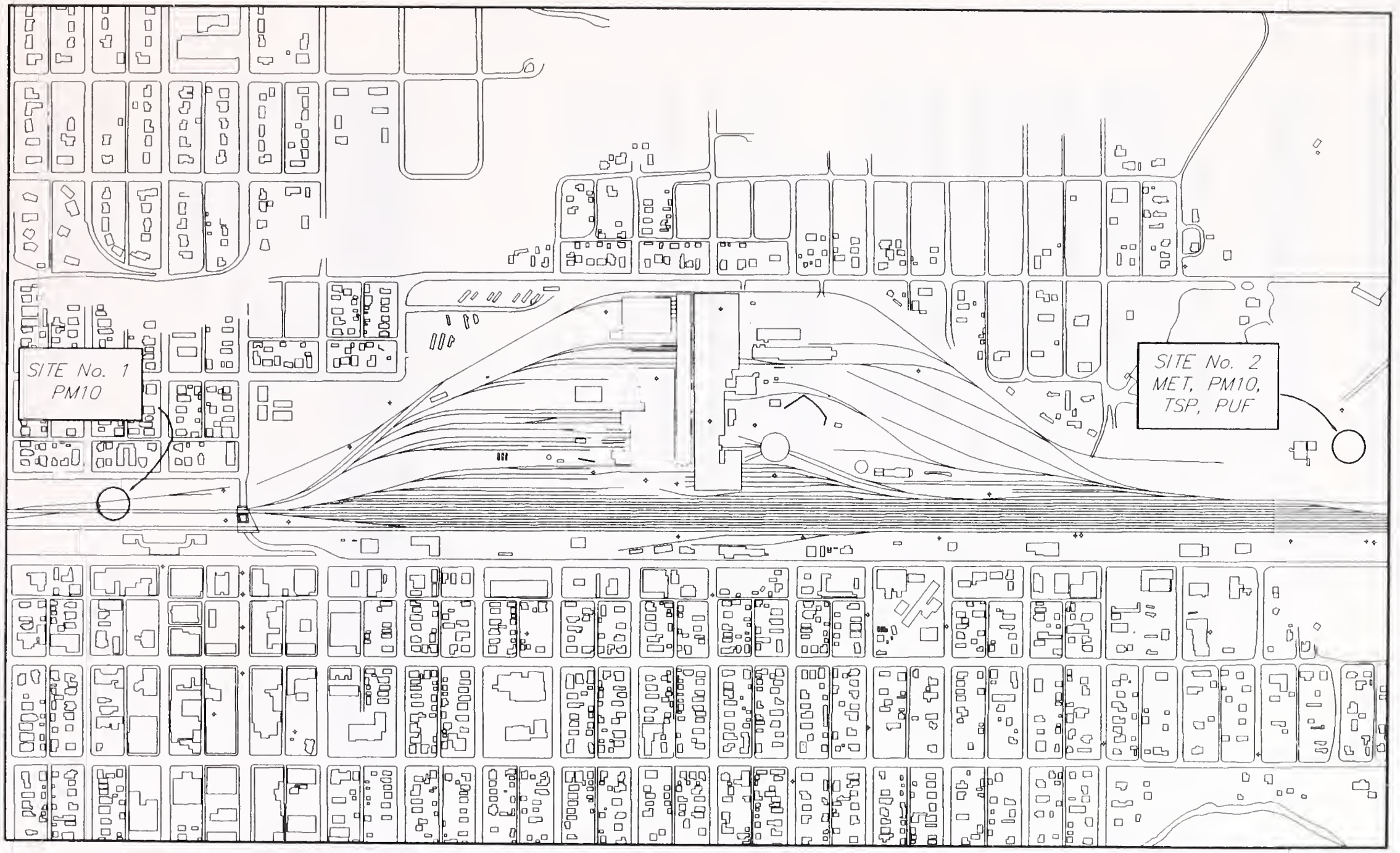
November 21, 1991

ENVIROCON, INC.

1.0 INTRODUCTION

This document presents the fourth quarter results of Burlington Northern Railroad's (BNRR) ambient monitoring investigations, conducted by Envirocon, Inc., for the Livingston rail yard project, in Livingston, Montana. The purpose of ambient air monitoring is to assess the impact of existing site contamination and remedial activities on ambient air quality. Ambient air monitoring data collection began on November 10, 1990 and will be conducted until December 24, 1991. This fourth quarterly report represents the period between July 1 and September 30, 1991

The design and operation of the ambient air monitoring program are in accordance with the Interim Remedial Measures Work Plan (IRMWP), as amended. Envirocon is responsible for the equipment's daily operations. Bison Engineering, Inc. provides assistance by conducting audits, performing the laboratory work, and assisting with quarterly-report data preparation.



BURLINGTON NORTHERN

AMBIENT AIR
MONITORING REPORT

UPWIND & DOWNWIND AMBIENT
AIR MONITORING LOCATIONS

ENVIROCON, INC.

140101

FIGURE 1.0

AutoCAD FILE: DM1.DWG

2.0 NETWORK CONFIGURATION

2.1 Monitoring Locations - General

The ambient air monitoring network consists of an upwind station and a downwind station. Each station contains a PM10 air monitoring instrument. The downwind station also contains meteorological equipment, a total suspended particulate (TSP) sampler (not presently in use), and a polynuclear aromatic hydrocarbon (PAH) sampler. PAH sampling and metal measurements were only required during the first six sampling events of the first quarter and TSP sampling was terminated at the beginning of July 1991, following MDHES' approval.

The upwind station measures ambient air quality upwind of all remedial activities. The downwind station is located to measure worst-case ambient air impacted by remediation activities. In addition, ambient air at the downwind station is impacted by current rail yard operations. Figure 1.0 shows the locations of both stations. The coordinate locations of these sites are shown on Table 1.0.

Table 1.0
Ambient Monitoring Locations

Station	UTM East	UTM North	North Latitude	West Longitude
Upwind	334050	5056410	45° 38' 36"	110° 33' 26"
Downwind	335360	5057520	45° 39' 13"	110° 32' 47"

UTM ZONE = 12

2.2 Monitoring Parameters

The ambient air monitoring system is designed to measure PM10, TSP, PAHs, and airborne metals. PAH sampling was conducted during the first six sample rounds at the downwind station. Analyses for metals were conducted during the first six sample rounds and metals were measured in both the upwind and downwind PM10 filter samples. These results were presented in the first Quarterly Ambient Air Monitoring Report. The following is a list of the parameters measured and the analytical methodologies used during the fourth quarter:

- PM10 - PM10 is particulate matter with an aerodynamic diameter of less than 10 microns. Both the upwind and downwind stations have PM10 samplers.

  Method: 40 CFR Part 50, Appendix J.

- TSP - While PM10 provides a health-basis comparison for human exposure to particulates, PM10 does not include all particulates suspended in the atmosphere. A TSP high-volume sampler is used for this collection. The data may be compared with an earlier, out-dated air quality standard for TSP. That standard was changed in 1987 to a PM10 methodology.

  Method: Sections 1.11.1, 2.1.1, and 2.1.1.1 of the Montana Air Quality Bureau Quality Assurance Manual.

- Meteorology - A meteorological tower was constructed at the downwind site in order to assess what meteorological events may lead to the increase or decrease of ambient air pollutants. The station recorded wind speed, wind direction, temperature, and wind sigma (standard deviation of the wind direction).

  Method: Anemometer cup, wind vane, thermocouple, and computer data acquisition system. (Ambient Monitoring Guidelines for Prevention of Significant Deterioration [PSD], Section 6, EPA, EPA-450/4-87-007).

2.3 Monitoring Frequency

The monitoring frequency for each parameter is shown on Table 2.0.

Table 2.0

Ambient Monitoring Frequency

PM10	One-day-in-six, 24-hour sample Upwind and downwind stations
TSP	One-day-in-six, 24-hour sample Downwind station only
Meteorology	Continuous sampling Hourly data analysis Downwind station only

3.0 DATA SUMMARY

3.1 PM10

Five PM10 samples were collected at the upwind station and three PM10 samples were collected at the downwind station between July 1 and September 30, 1991. The mean PM10 values for this period were 28 ug/m^3 at the upwind station and 24 ug/m^3 at the downwind station. The peak PM10 reporting values for the upwind and downwind stations were 56 and 28 ug/m^3, respectively. These values are compared against the Montana ambient air quality standards on Table 3.0.

Table 3.0
PM10 Results vs Ambient Standards

	Standard	Upwind Station	Downwind Station
Arithmetic Mean	50*	28	24
Peak	150**	56	28

Units: ug/m^3
* Annual mean
** Not to be exceeded more than once per year

Complete PM10 data and summary statistics are provided in Appendix A. The statistics include monthly means, yearly means to-date, geometric means, and standard deviations. Appendix B contains the results of calibrations, audits, and precision checks.

3.2 TSP

One TSP sampler was operated at the downwind monitoring station. One sample was collected between July 1, and September 30, 1991. The TSP value for this sample was 48 ug/m^3.

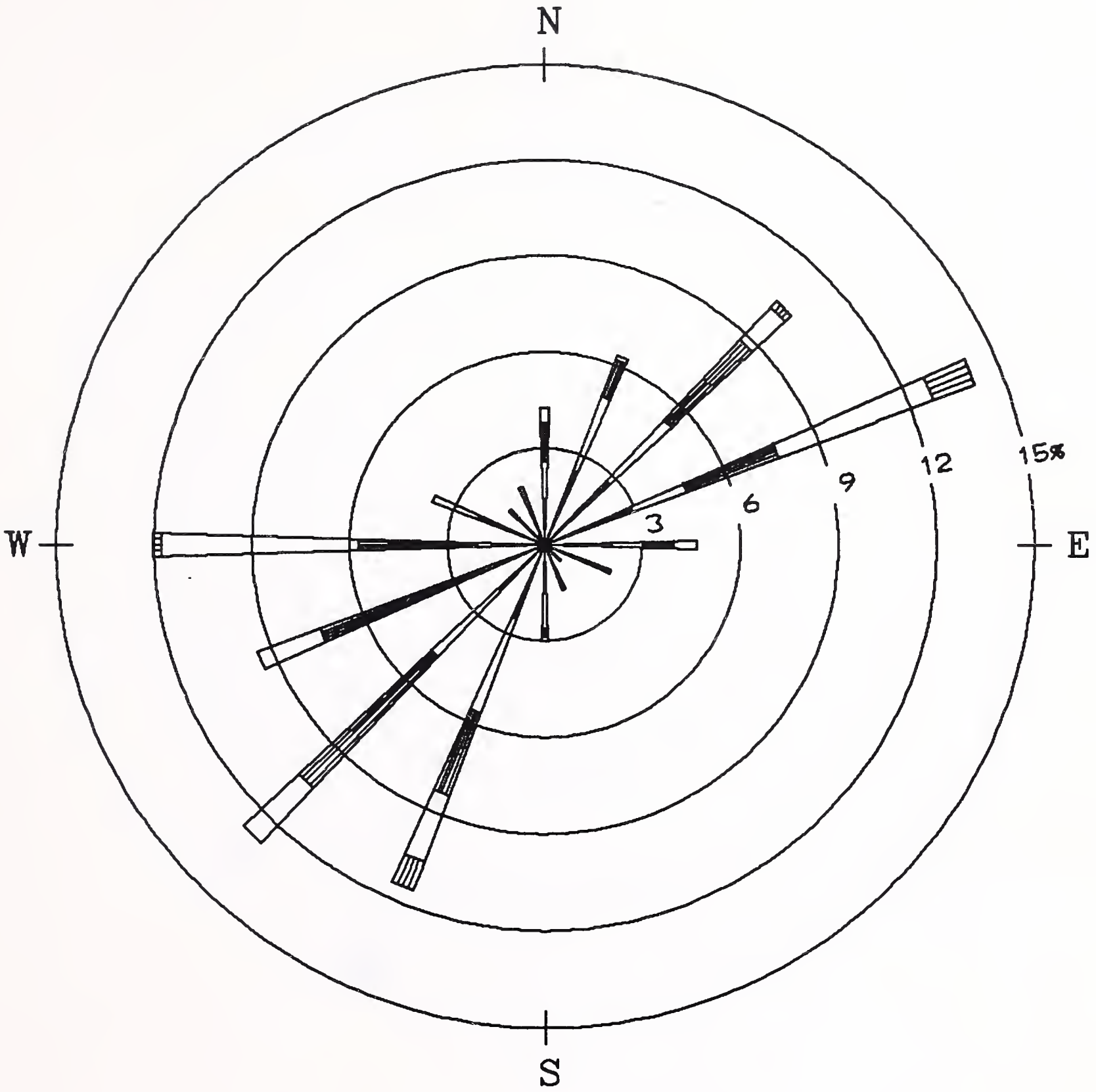
Complete TSP data and summary statistics are in Appendix A. The statistics include monthly means, yearly means to-date, geometric means and standard deviations. No calibrations or audits were performed on the TSP sampler during this period, because sampling had officially been terminated before the period began.

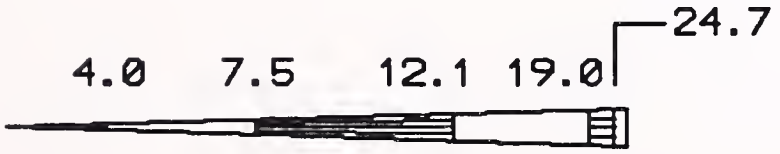
3.3 Meteorology

The meteorological station at the downwind site measures wind speed, wind direction, temperature, and wind sigma. Overall data recovery for the meteorological system was good during the fourth quarter of operation. Data for 13 days in August are missing due to a corrupted data file. The data are not recoverable.

Between July 1 and September 30, 1991, the average wind speed was 9.0 miles per hour, the resultant wind direction was 235.5 degrees, and the percentage of calm hours was 0.0 percent. The maximum temperature during this period was 93° F, the minimum temperature was 32° F, and the average temperature was 66° F.

Appendix A contains a complete listing of the meteorological information for wind speed, wind direction, temperature, and wind sigma. Appendix A also contains monthly and seasonal (to-date) wind-frequency distribution data. Wind roses are shown on Figures 2.0 through 5.0.





Wind Speed Class Boundaries
(Miles/Hour)

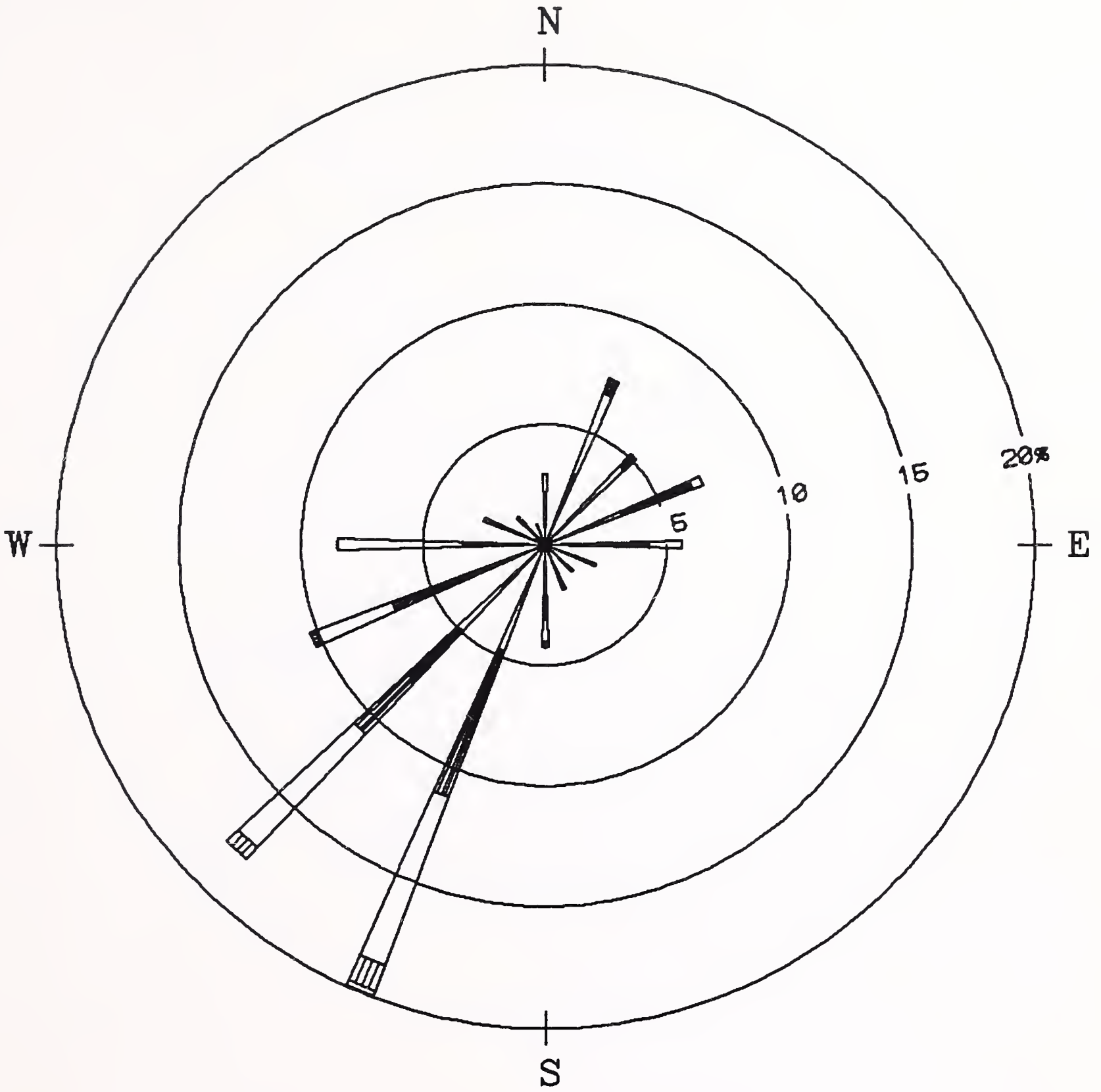
NOTES:
Diagram of the Frequency of
Occurrence for each Wind Direction.
Wind Direction is the Direction
From Which the Wind is Blowing.

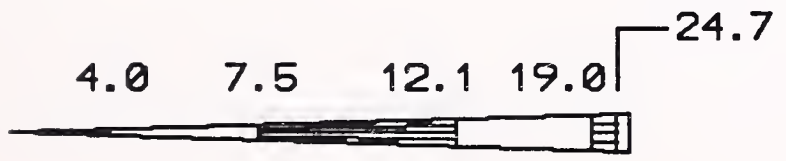
WINDROSE

Livingston Railyard
PERIOD: July 1991

FIGURE: 1.0

Bison
Engineering





Wind Speed Class Boundaries
(Miles/Hour)

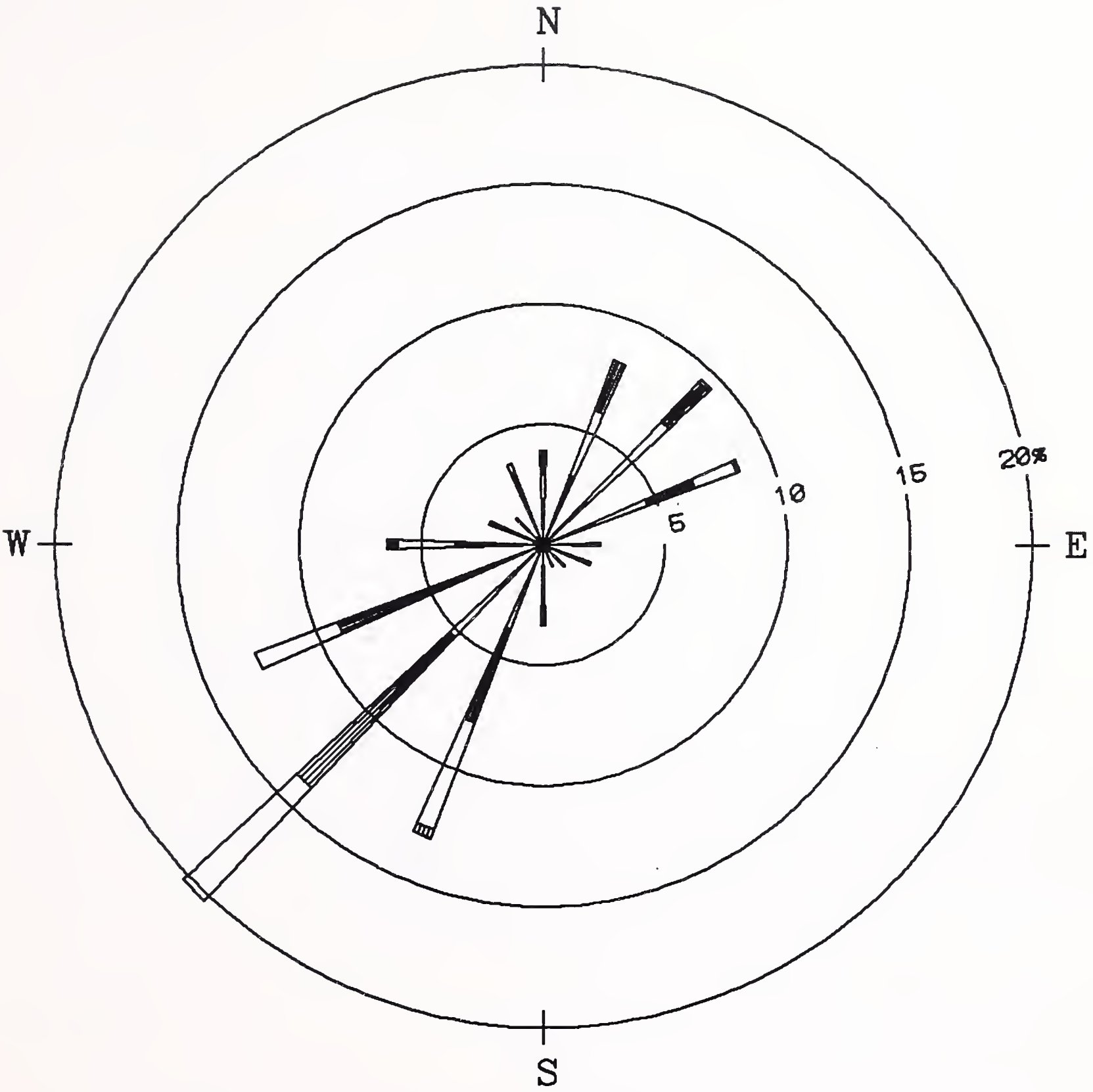
NOTES:
Diagram of the Frequency of
Occurrence for each Wind Direction.
Wind Direction is the Direction
From Which the Wind is Blowing.

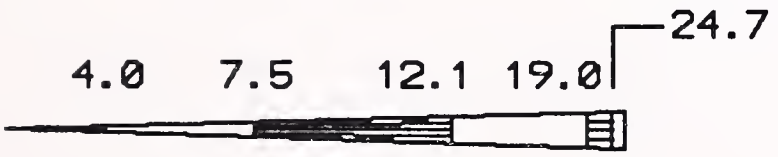
WINDROSE

Livingston Railyard
PERIOD: August 1991

FIGURE: 2.0

Bison
Engineering





Wind Speed Class Boundaries
(Miles/Hour)

NOTES:
Diagram of the Frequency of Occurrence for each Wind Direction.
Wind Direction is the Direction From Which the Wind is Blowing.

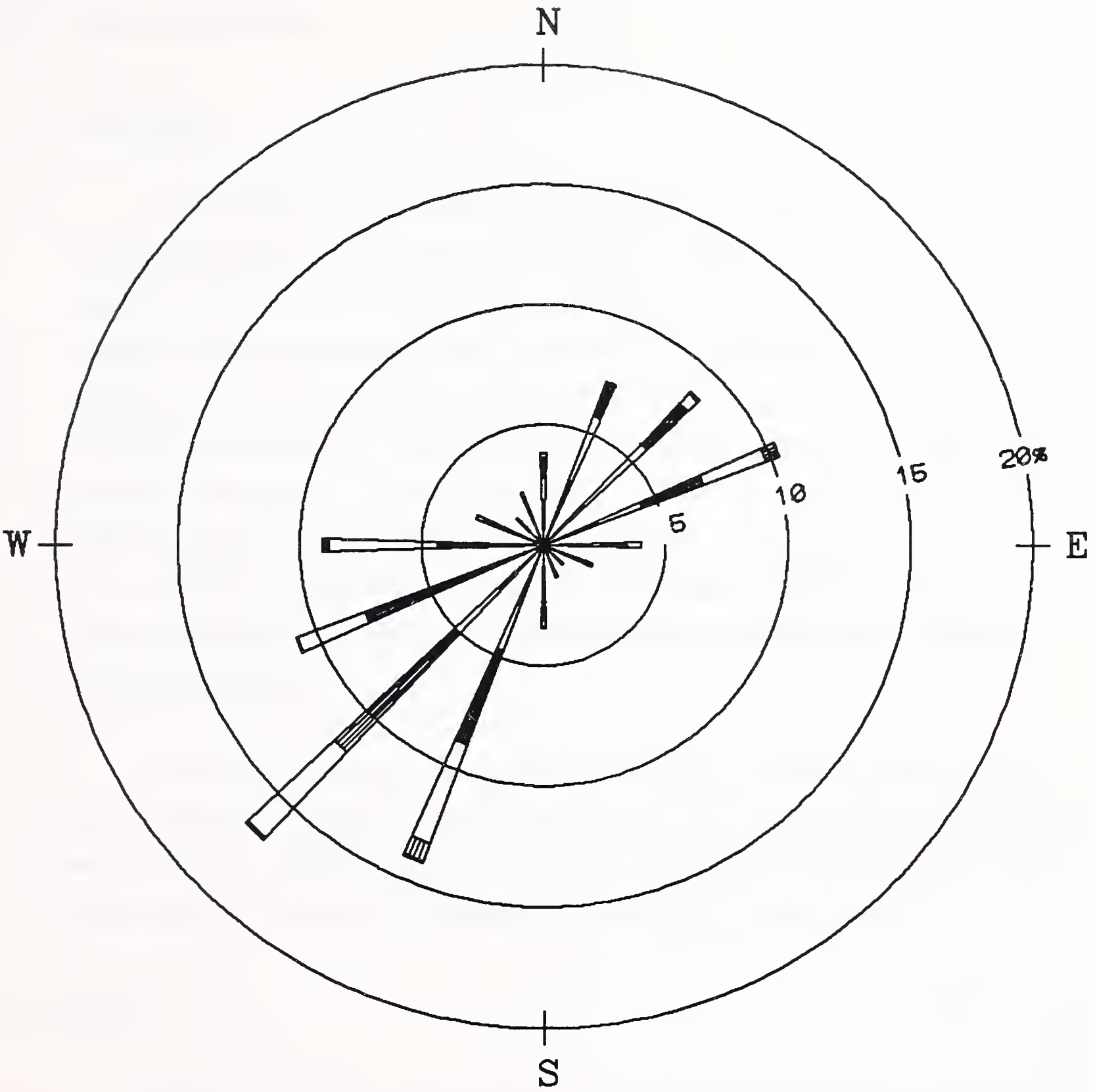
WINDROSE

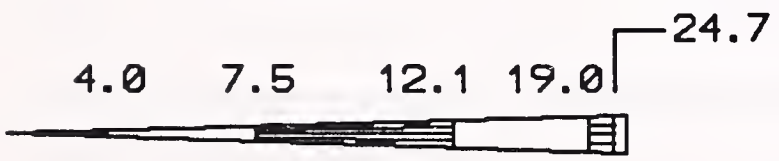
Livingston Railyard

PERIOD: September 19

FIGURE: 3.0

Bison Engineering





Wind Speed Class Boundaries
(Miles/Hour)

NOTES:
Diagram of the Frequency of
Occurrence for each Wind Direction.
Wind Direction is the Direction
From Which the Wind is Blowing.

WINDROSE

Livingston Railyard
PERIOD: 3rd Q 1991

FIGURE: 4.0

Bison
Engineering

4.0 DATA ANALYSIS

4.1 Introduction

The purpose of the ambient air monitoring network is to assess the impacts of existing site contamination and remedial activities on ambient air quality. However, the ambient air monitoring network can not distinguish between sources associated with previous site contamination and sources associated with current industrial operations. The first step of assessment is to measure parameters which could be reasonably expected to enter the ambient atmosphere. These parameters, defined by Section 14.4 of the IRMWP, include PM10, TSP, metals, and PAHs. The second step of the assessment is to compare these results with previously established ambient air quality standards. The final step of assessment is to compare the results with background results.

This report does not provide the investigative details for each of the above activities; however, it does assess some of the characteristics of the results to-date. The following is a discussion of PM10 and TSP results. The metal and PAH results were discussed in the first quarterly report.

4.2 PM10

Section 3.0 of this report provides a comparison between the collected PM10 values and the Montana and EPA ambient air quality standards. The results indicate values well below these standards. All information collected to-date indicates that the standards will not be exceeded. Envirocon compared the upwind and downwind PM10 data, and the results of this investigation are provided on Table 4.0.

Table 4.0

Upwind/Downwind PM10 Comparison

SAMPLE DATE	UPWIND	DOWNWIND	DIFFERENCE
7/5/91	18	22	-4
7/25/91	24	28	-4
8/25/91	21	N/A	
9/24/91	56	N/A	
9/30/91	19	22	-3

Units: Micrograms/cubic meter

Two statistical tests were applied to the data. The tests (paired and unpaired t-tests) were designed to assess whether or not there is enough evidence to reject the null hypothesis that the two means are the same. The results of these tests are summarized on Table 5.0.

Table 5.0

Summary Statistics

UPWIND	Mean: Std Dev: No. of Samples:	27.78 14.38 5
DOWNWIND	Mean: Std Dev: No. of Samples:	24.23 2.81 3
DIFFERENCE	Mean: Std Dev: No. of Samples:	-3.73 0.45 3

Comparison of Upwind and Downwind Means

Paired difference t-test:

t = Mean/(S/(n)^.5) where S = standard deviation

t = 14.36

Critical t (95%) = +/- 4.30

The t value for the paired difference t-test falls outside the 95-percent two-tailed confidence interval (as defined by the critical t value). It is concluded that some evidence exists for rejecting the null hypothesis. In this case, it appears that there may be a difference between the mean PM10 values for the two monitoring sites. However, the sample population (number of paired samples) is very small. With a population of three samples, no significant conclusions can be made.

Unpaired t-test:

$t = (mean_1 - mean_2)/(S*(1/n_1+1/n_2)^{\wedge}.5)$ where S = pooled std. dev.

t = 0.42

Critical t (95%) = +/- 2.45

The t value for the unpaired t-test falls within the 95-percent two-tailed confidence interval (as defined by the critical t value). It is concluded that not enough evidence is present to reject the null hypothesis. Therefore, it appears that there is no difference in the mean PM10 values between the two monitoring sites. However, the sample populations are small. With populations of three samples downwind and five samples upwind, no firm conclusions can be made.

4.3 TSP

Only one TSP filter was sampled during the fourth quarter because TSP sampling had been officially terminated. The results of TSP sampling to-date indicate values well below the outdated ambient air quality standard. These results are shown in Section 3.0 of this report.

APPENDIX A

ENVIROCON, INC.

Bison Engineering Inc

Helena, MT 59601

PM10 Particulate Summary

1991 Site & Area: 1111 3

Upwind Site Livingston, MT Envirocon

(Values are in Micrograms per Cubic Meter)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-	-	19	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	15	-	-	-	-	18	-	-	-	-	-
6	-	-	-	12	18	19	-	-	-	-	-	-
7	-	-	12	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	19	-	-	-	28	-	-	-	-	-	-
12	14	-	-	13	12	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	39	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	9	-	-	-	12	-	-	-	-	-	-
18	13	-	-	10	13	-	-	-	-	-	-	-
19	-	-	40	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	15	-	-	-	-	-	-	-	-	-	-
24	15	-	-	19	22	21	-	-	56	-	-	-
25	-	-	13	-	-	-	24	21	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-
30	22	-	-	22	16	10	-	-	19	-	-	-
31	-	-	16	-	-	-	-	-	-	-	-	-
No.	4	4	6	5	5	5	2	1	2	0	0	0
Max	22	19	40	22	22	28	24	21	56			
Avg	16	15	23	15	16	18	21	21	38			

Bison Engineering Inc

Helena, MT 59601

PM10 Particulate Summary

1991 Site & Area: 1111 4

Downwind Site Livingston, MT Envirocon

(Values are in Micrograms per Cubic Meter)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-	-	8	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	12	-	-	-	-	22	-	-	-	-	-
6	17	-	-	11	16	-	-	-	-	-	-	-
7	-	-	15	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	18	-	-	-	34	-	-	-	-	-	-
12	-	-	-	6	6	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	28	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	14	-	-	-	19	-	-	-	-	-	-
18	13	-	-	5	11	-	-	-	-	-	-	-
19	-	-	20	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	13	-	-	-	-	-	-	-	-	-	-
24	9	-	-	19	15	18	-	-	-	-	-	-
25	-	-	8	-	-	-	28	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-
30	24	-	-	22	-	18	-	-	22	-	-	-
31	-	-	15	-	-	-	-	-	-	-	-	-
No.	4	4	6	5	4	4	2	0	1	0	0	0
Max	24	18	28	22	16	34	28		22			
Avg	16	14	16	13	12	22	25		22			

Bison Engineering Inc.
Helena, MT 59601

SUMMARY STATISTICS FOR THE PM10 PARTICULATE DATA

1991

Livingston, MT Envirocon

	Site #	Min	Max	2nd Max	# > 150	Arith. Mean	Arith. Std Dev	Geo. Mean	Geo. Std Dev	Total # Obs.
Upwind	3	9	56	40	0	19	10	17	1.5	34
Downwind	4	5	34	28	0	16	7	15	1.6	30

Bison Engineering Inc

Helena, MT 59601

Total Suspended Particulate Summary

1991 Site & Area: 1111 4

Downwind Site Livingston, MT Envirocon

(Values are in Micrograms per Cubic Meter)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	-	-	20	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	30	-	-	-	-	48	-	-	-	-	-
6	33	-	-	22	25	19	-	-	-	-	-	-
7	-	-	29	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	61	-	-	-	67	-	-	-	-	-	-
12	43	-	-	9	23	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	41	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	38	-	-	-	41	-	-	-	-	-	-
18	37	-	-	7	28	-	-	-	-	-	-	-
19	-	-	43	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
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22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	30	-	-	-	-	-	-	-	-	-	-
24	18	-	-	48	27	38	-	-	-	-	-	-
25	-	-	18	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-
30	62	-	-	39	29	35	-	-	-	-	-	-
31	-	-	38	-	-	-	-	-	-	-	-	-
No.	5	4	6	5	5	5	1	0	0	0	0	0
Max	62	61	43	48	29	67	48					
Avg	39	40	32	25	26	40	48					

Bison Engineering Inc.
Helena, MT 59601

SUMMARY STATISTICS FOR THE TSP PARTICULATE DATA

1991

Downwind Site Livingston, MT Envirocon

Site #	Min	Max	2nd Max	# > 150	Arith. Mean	Arith. Std Dev	Geo. Mean	Geo. Std Dev	Total # Obs.
4	7	67	62	0	34	14	30	1.7	31

BISON ENGINEERING INC.
HELENA, MONTANA

Envirocon — Livingston, Montana — JULY 1991

*** *TEMPERATURE SUMMARY (DEG F)* ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	55	55	55	55	55	55	57	59	61	63	64	66	66	68	70	72	72	72	72	70	64	59	57	52	62
2	54	52	50	48	48	46	52	61	64	70	72	75	75	77	77	79	79	79	77	75	68	66	63	57	65
3	55	54	50	50	50	52	59	66	70	73	77	81	82	84	84	86	86	88	86	82	73	68	68	68	71
4	68	66	57	59	52	63	68	72	75	79	82	84	88	88	88	90	90	86	77	73	75	73	72	70	75
5	70	68	66	64	61	61	64	68	72	75	77	81	82	84	86	86	86	86	86	81	73	70	66	63	74
6	61	59	54	54	52	54	59	66	70	72	73	77	79	81	82	82	82	82	79	75	70	68	64	59	69
7	57	55	54	52	50	50	52	52	54	55	59	61	63	64	64	66	66	66	66	64	61	59	57	55	58
8	55	54	50	50	48	50	55	57	63	68	73	77	81	82	82	82	84	82	79	73	70	68	66	66	67
9	63	63	61	59	57	57	63	66	70	72	75	77	77	77	77	81	82	82	81	77	73	73	66	64	71
10	64	64	63	63	61	61	64	64	68	70	73	73	73	75	79	79	79	77	77	70	64	64	61	59	69
11	55	54	54	54	54	54	57	61	66	70	73	75	77	79	81	81	82	82	81	75	70	66	64	63	68
12	61	57	55	54	54	52	55	61	66	72	75	77	81	84	86	86	86	88	84	79	75	70	66	64	70
13	63	61	59	57	54	54	59	63	70	77	84	88	88	88	90	91	90	88	86	79	77	73	79	72	74
14	70	66	64	64	66	66	68	70	75	79	82	86	84	82	81	82	86	90	81	77	72	68	64	64	75
15	61	59	57	55	54	55	59	64	72	77	82	84	86	90	90	90	90	86	82	79	77	75	72	70	74
16	72	66	63	61	59	61	64	68	72	73	77	82	84	84	84	84	84	84	82	82	79	75	73	68	74
17	63	59	57	55	54	54	57	64	75	81	86	91	91	91	91	91	88	88	86	81	72	66	64	63	74
18	59	59	59	57	55	54	59	61	64	66	70	72	73	75	77	79	79	79	79	77	68	66	63	59	67
19	55	54	52	50	48	48	54	57	64	70	75	81	81	82	84	84	84	84	82	81	77	73	72	68	69
20	66	63	59	55	54	54	61	63	68	72	77	81	82	81	82	86	82	81	77	73	72	72	66	64	70
21	66	66	66	66	66	64	66	68	70	73	77	82	84	86	86	88	88	88	86	81	75	72	72	70	75
22	70	66	64	61	59	61	63	64	66	70	72	73	75	77	79	79	79	77	75	73	72	70	68	66	70
23	64	63	61	61	57	57	61	63	64	66	68	70	73	75	75	75	75	75	73	72	70	66	64	63	67
24	61	61	59	57	57	57	59	63	64	68	72	73	75	75	77	77	77	77	77	75	72	70	68	66	68
25	63	59	57	55	54	55	55	63	66	70	70	73	79	77	75	72	73	68	64	63	61	63	61	61	65
26	61	61	59	59	59	59	61	63	63	64	70	73	77	79	81	81	81	81	81	77	72	72	68	66	69
27	61	61	59	55	54	54	57	64	70	73	77	79	81	82	82	84	84	84	84	81	75	68	68	64	71
28	63	63	61	55	54	54	55	63	73	77	81	84	86	88	88	90	90	90	88	84	75	72	68	63	73
29	59	59	57	55	52	54	63	70	73	77	81	86	90	91	91	93	91	88	86	84	82	79	77	77	76
30	77	72	68	63	61	61	64	70	75	77	81	84	86	88	88	88	88	88	86	82	79	77	72	68	77
31	64	63	59	55	55	55	64	68	72	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
AVG.	62	61	58	57	55	56	60	64	68	72	75	78	80	81	82	83	83	82	80	77	72	69	67	64	

MINIMUM T = 46 MAXIMUM T = 93 AVERAGE T = 70 HOURS OF DATA = 730

BISON ENGINEERING INC.
HELENA, MONTANA

Envirocon Livingston, Montana AUGUST 1991

*** TEMPERATURE SUMMARY (DEG F) ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
13	-	-	-	-	-	-	-	-	-	-	77	82	84	88	90	90	88	86	84	81	79	79	75	73	83
14	68	72	72	68	63	61	59	66	68	72	75	77	79	82	82	82	82	82	81	77	72	68	66	64	72
15	63	63	59	57	55	54	59	61	64	66	70	73	79	82	82	82	81	73	70	68	66	64	61	61	67
16	59	57	55	54	52	52	55	63	66	72	73	77	79	79	81	81	82	81	77	73	72	70	68	66	68
17	63	59	57	55	54	52	55	61	66	70	73	75	79	81	77	77	75	75	75	72	72	70	64	63	67
18	63	61	55	54	52	52	55	64	66	73	77	81	84	86	88	88	86	88	86	79	72	68	64	63	71
19	61	59	55	55	55	54	59	70	73	77	79	84	86	88	88	88	88	86	81	77	75	75	73	72	73
20	72	70	68	68	66	66	66	68	70	75	81	81	82	84	86	86	88	88	86	79	73	73	70	68	76
21	68	66	66	64	63	64	68	70	73	79	82	86	88	90	90	90	90	90	88	82	81	79	77	75	78
22	73	72	72	72	72	70	68	70	73	79	82	86	88	88	90	90	86	88	82	79	75	73	72	70	78
23	70	72	70	70	68	66	66	68	70	72	75	79	84	86	88	84	77	79	77	73	70	72	66	64	74
24	64	63	61	59	57	54	57	63	68	73	81	84	88	88	88	88	88	82	81	79	77	75	73	68	73
25	64	61	59	55	57	61	73	77	79	81	84	86	88	88	88	90	86	86	82	73	73	73	72	73	75
26	72	70	61	59	59	55	61	70	75	79	82	82	82	82	86	82	70	64	63	61	61	63	66	68	70
27	66	66	66	66	66	66	68	68	70	75	79	82	86	86	86	84	81	77	75	68	68	68	66	64	73
28	61	61	61	59	59	57	57	57	61	66	70	73	73	75	75	75	77	75	73	72	70	68	68	68	67
29	66	64	64	63	61	61	61	63	66	70	73	77	81	82	84	84	86	86	81	73	66	66	64	59	71
30	55	54	52	50	50	52	61	61	70	73	77	84	88	90	90	90	90	90	82	75	70	64	63	59	70
31	57	55	54	52	52	52	54	61	66	77	82	88	93	93	93	91	90	88	84	79	77	81	81	79	74
AVG.	65	63	62	60	59	58	61	66	69	74	78	81	84	85	86	85	84	82	79	75	72	71	69	67	

MINIMUM T = 50 MAXIMUM T = 93 AVERAGE T = 72 HOURS OF DATA = 446

BISON ENGINEERING INC.
HELENA, MONTANA

Envirocon — Livingston, Montana — SEPTEMBER 1991

*** *TEMPERATURE SUMMARY (DEG F)* ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	75	73	72	72	70	70	70	72	72	75	79	82	82	84	86	86	84	82	79	79	75	73	72	70	76
2	68	66	64	61	57	55	57	63	66	68	73	75	75	79	81	81	81	79	77	72	68	66	66	63	69
3	61	57	57	55	52	50	50	54	59	61	64	68	70	73	73	75	75	75	72	66	64	57	57	54	63
4	50	48	48	45	43	43	45	52	55	63	68	73	77	81	82	82	82	84	77	72	70	68	66	64	64
5	61	57	57	57	54	50	52	55	63	64	66	70	72	73	75	75	75	75	72	68	63	61	59	55	64
6	52	50	48	46	46	46	48	59	66	72	77	81	84	84	86	86	84	84	81	77	72	70	68	64	68
7	64	63	63	59	57	55	55	57	61	68	72	72	72	68	70	70	70	68	68	66	64	64	61	59	64
8	59	59	59	59	57	63	59	59	59	63	66	64	55	55	55	57	57	57	55	54	54	54	52	52	58
9	50	48	48	48	46	46	46	46	48	48	48	48	48	48	50	50	48	48	48	48	48	48	48	46	48
10	48	48	48	46	48	48	48	52	52	55	57	61	64	66	66	68	64	61	57	57	55	55	55	57	56
11	55	55	55	55	54	54	54	55	57	59	61	59	63	64	66	66	64	63	59	57	57	57	57	55	58
12	55	54	54	54	54	52	54	54	55	59	63	66	70	70	72	72	72	72	66	61	57	57	57	57	61
13	57	59	57	57	57	55	55	57	59	63	66	70	73	73	73	73	68	66	64	57	55	55	54	52	62
14	48	48	46	43	43	43	43	45	46	46	46	48	46	46	48	45	45	45	43	43	43	43	45	45	45
15	45	45	45	45	45	43	45	46	50	50	52	54	55	57	57	59	61	59	57	57	57	55	55	54	52
16	52	52	50	50	50	50	50	52	52	54	55	57	61	63	63	63	63	61	54	50	50	48	48	48	54
17	46	46	46	46	45	45	45	46	46	48	48	48	48	50	52	52	52	50	48	46	45	43	41	39	47
18	37	34	34	32	36	36	36	37	41	45	50	54	57	61	63	63	61	57	54	48	45	43	41	37	46
19	37	37	36	36	36	41	46	48	52	55	61	64	70	73	75	75	75	73	64	59	57	59	57	57	56
20	57	59	57	59	55	57	57	59	61	63	68	72	77	79	81	82	82	79	75	73	72	72	70	68	68
21	66	61	55	54	50	48	46	46	46	48	50	52	54	54	52	54	50	46	46	46	46	45	41	39	50
22	41	41	41	39	39	37	36	39	46	46	50	52	55	57	57	57	57	55	54	54	50	48	52	54	48
23	55	55	54	55	54	54	54	54	52	54	54	57	57	59	59	61	61	59	54	50	48	46	46	50	54
24	50	50	48	48	46	46	46	48	52	55	59	64	68	68	72	73	73	72	68	64	64	59	55	52	58
25	50	46	45	43	43	41	41	45	50	57	63	68	72	73	75	77	77	73	64	59	57	55	48	46	57
26	46	45	50	52	52	52	52	54	57	61	64	68	75	79	81	81	77	73	66	61	61	57	54	50	61
27	48	46	46	46	41	39	39	43	52	59	64	66	70	72	72	72	72	68	63	59	55	54	52	50	56
28	46	45	46	45	50	52	55	59	61	64	64	64	66	66	68	70	68	64	63	64	63	61	59	61	59
29	61	59	59	59	57	54	52	52	55	59	61	63	66	66	68	68	64	63	59	57	54	52	50	48	59
30	46	45	43	41	41	41	43	52	54	57	63	68	70	70	70	72	72	70	68	66	64	66	66	64	59
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AVG.	53	52	51	50	49	49	49	52	55	58	61	64	66	67	68	69	68	66	62	60	58	56	55	54	

MINIMUM T = 32 MAXIMUM T = 86 AVERAGE T = 58 HOURS OF DATA = 720

BISON ENGINEERING INC.
HELENA, MONTANA

Envirocon Livingston, Montana JULY 1991

*** *WIND SIGMA SUMMARY (DEGREES)* ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	14	9	11	13	19	17	21	14	14	16	13	15	15	17	16	16	13	11	14	10	65	36	41	69	21
2	15	62	56	56	67	18	13	72	15	63	45	75	20	46	62	43	48	29	19	41	17	28	24	76	42
3	45	69	40	35	62	54	60	13	14	18	26	23	22	30	17	17	47	35	37	21	37	24	15	10	32
4	9	28	69	69	58	41	13	11	13	20	23	19	23	16	13	15	18	16	44	15	13	20	16	13	25
5	16	19	22	73	18	12	54	48	41	55	34	66	51	38	25	16	16	13	12	49	26	77	24	15	34
6	26	69	65	40	23	24	26	58	57	22	11	15	15	17	12	14	13	25	11	18	25	20	24	17	27
7	17	18	60	31	52	26	38	30	14	15	15	17	16	15	14	14	13	12	12	11	12	13	63	62	25
8	21	42	13	18	10	13	14	11	19	62	71	58	66	18	15	17	22	27	17	11	12	13	11	13	25
9	20	18	39	84	65	22	19	48	39	27	37	29	24	29	63	17	24	20	17	12	17	53	13	21	32
10	60	28	17	17	11	69	83	46	20	29	22	22	17	21	18	17	18	14	67	33	23	21	23	33	30
11	33	18	20	10	19	78	19	14	24	61	69	19	24	24	26	24	39	60	73	17	12	16	16	26	31
12	67	16	10	13	38	29	27	24	42	58	44	20	13	33	44	42	16	18	14	11	11	63	18	23	29
13	16	15	19	58	27	68	23	14	16	28	55	40	24	14	31	19	18	15	33	52	54	69	54	79	35
14	41	34	46	41	80	52	65	61	22	63	17	19	51	23	54	50	49	34	20	52	56	39	66	29	44
15	71	60	48	77	48	19	15	40	48	54	59	35	35	46	59	70	25	15	30	53	83	42	39	57	47
16	13	16	47	36	37	66	60	49	26	15	14	13	33	39	19	14	19	13	11	13	30	49	48	64	31
17	60	74	75	81	80	25	27	24	75	28	63	58	31	21	15	17	28	21	14	51	13	38	14	44	41
18	59	68	34	50	23	56	51	59	48	19	17	15	14	17	14	17	15	15	16	48	46	52	43	67	36
19	37	62	11	77	16	37	46	27	64	37	50	35	13	16	16	12	12	13	23	14	43	23	20	15	30
20	13	52	47	37	57	13	29	30	21	20	17	25	50	41	16	58	64	13	36	24	14	22	28	21	31
21	10	10	12	11	17	14	11	10	11	14	12	33	30	27	28	23	25	25	17	32	34	37	26	22	20
22	27	11	23	72	37	16	21	23	15	17	16	14	15	14	13	13	12	12	11	9	9	10	11	10	18
23	11	13	15	13	18	13	32	12	14	14	14	14	15	14	13	12	12	10	10	10	10	11	12	20	14
24	16	11	17	10	12	12	14	26	12	13	13	14	13	15	15	12	13	12	12	13	11	10	16	16	14
25	39	10	19	32	73	31	25	24	20	32	16	18	15	14	17	13	32	37	17	15	15	17	18	18	24
26	19	12	12	13	21	31	21	13	16	15	25	35	33	34	21	18	18	14	32	33	52	72	30	62	27
27	27	17	82	24	22	16	19	69	72	38	44	21	28	34	21	24	20	16	15	10	60	53	29	80	35
28	40	14	62	47	20	30	18	13	79	15	27	35	24	30	23	40	36	13	14	41	20	33	63	74	34
29	38	45	49	80	44	48	57	16	12	12	12	28	50	32	53	27	36	12	21	30	40	79	56	17	37
30	33	62	58	65	15	69	67	15	62	31	29	52	15	18	20	20	17	18	21	17	24	25	72	55	37
31	40	25	54	37	62	38	48	15	14	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35
AVG.	31	32	37	43	37	34	33	30	31	30	30	29	27	25	26	24	25	20	23	26	29	36	31	38	

BISON ENGINEERING INC.
HELENA, MONTANA

Envirocon Livingston, Montana AUGUST 1991

*** *WIND SIGMA SUMMARY (DEGREES)* ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
13	-	-	-	-	-	-	-	-	-	-	43	59	22	81	87	86	73	17	43	11	14	12	13	21	42
14	21	17	16	53	72	25	72	42	28	44	28	24	19	16	22	52	12	12	33	30	13	13	11	14	29
15	35	33	71	24	52	42	62	40	64	34	56	42	65	38	20	20	17	35	10	13	15	19	13	76	37
16	57	86	25	66	64	86	47	72	23	55	70	72	24	17	12	18	39	26	15	11	14	28	17	27	40
17	78	31	14	75	75	66	16	34	48	23	22	33	40	45	29	18	13	12	16	12	13	28	16	17	32
18	17	45	34	43	16	30	63	39	13	36	42	52	47	24	47	64	21	37	12	56	27	70	79	48	40
19	32	49	30	71	42	26	68	13	13	11	12	20	17	15	19	24	13	11	14	25	21	13	16	11	24
20	12	16	11	11	11	11	13	11	9	15	28	15	16	16	15	18	16	14	14	18	13	45	21	11	16
21	9	9	9	8	9	10	17	12	12	11	46	23	19	21	17	22	16	17	26	33	45	28	20	24	19
22	15	16	16	14	10	15	12	25	16	13	14	34	18	17	22	27	23	26	54	44	14	71	44	12	24
23	24	25	21	18	22	27	62	53	15	26	15	14	15	16	14	35	57	57	51	47	56	44	80	29	34
24	16	62	54	30	55	48	61	28	52	37	71	68	75	42	68	28	36	17	18	19	18	16	26	48	41
25	74	79	59	34	23	52	13	12	11	12	12	12	12	20	26	21	17	13	59	31	51	52	58	11	32
26	27	21	35	60	42	33	35	49	21	15	12	13	26	18	39	62	23	33	71	63	32	26	24	14	33
27	16	15	30	58	67	10	15	19	30	21	14	16	20	28	36	45	55	44	70	27	61	13	16	23	31
28	10	13	8	9	17	12	9	9	20	18	18	29	12	23	27	30	16	11	10	11	12	11	10	17	15
29	12	18	16	28	16	11	13	13	20	23	16	14	16	14	18	18	32	22	58	55	55	29	77	24	26
30	36	13	19	23	40	68	81	42	52	37	16	24	50	49	34	42	20	21	37	51	28	50	81	61	41
31	86	63	28	49	35	35	23	28	18	74	26	50	55	29	32	15	13	15	22	66	23	11	41	18	36
AVG.	32	34	28	37	37	34	38	30	26	28	30	32	30	28	31	34	27	23	33	33	28	30	35	27	

BISON ENGINEERING INC.
HELENA, MONTANA

Envirocon Livingston, Montana SEPTEMBER 1991

*** *WIND SIGMA SUMMARY (DEGREES)* ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	12	11	13	8	12	19	12	20	20	12	16	15	14	15	20	25	16	23	12	21	23	18	27	81	19
2	14	63	44	85	72	63	46	19	27	49	67	37	12	15	12	12	11	10	73	24	29	32	16	32	36
3	26	14	15	11	11	10	69	40	64	80	48	39	29	30	16	16	11	10	22	28	61	16	15	69	31
4	47	51	69	25	29	31	32	45	28	25	31	23	33	48	29	17	36	37	48	29	20	13	11	11	32
5	19	9	10	10	46	35	19	19	69	23	31	25	28	16	17	15	14	13	19	15	62	21	29	36	25
6	53	31	50	26	26	23	39	61	19	16	54	39	36	34	31	13	29	27	62	55	73	55	16	67	39
7	70	67	65	87	26	79	59	89	34	82	80	24	10	13	14	22	15	9	16	60	20	78	40	22	45
8	82	49	50	55	70	18	10	57	43	40	62	78	22	60	15	32	16	54	12	18	13	15	12	11	37
9	17	13	13	11	14	12	11	9	9	10	11	11	12	11	11	12	11	12	13	12	10	11	11	16	12
10	47	14	16	23	29	84	23	29	26	59	25	31	24	17	24	64	21	27	30	26	19	14	16	20	30
11	26	14	17	54	34	13	22	18	39	28	41	27	53	57	49	47	11	9	35	30	62	15	18	16	31
12	17	12	12	11	12	12	12	12	12	11	12	14	31	45	38	29	16	11	19	62	32	18	39	42	22
13	30	18	15	13	14	13	12	10	16	12	12	13	22	20	24	21	25	30	29	11	37	43	51	50	23
14	14	43	21	19	12	15	12	11	19	30	21	43	31	16	17	16	23	28	11	13	11	10	10	13	19
15	11	14	14	15	19	20	12	12	14	15	18	21	19	13	14	19	15	17	18	19	16	13	10	13	15
16	11	11	12	16	11	10	16	13	20	14	25	16	16	24	13	10	78	27	37	23	28	25	25	47	22
17	66	31	45	19	22	45	52	59	25	63	37	25	16	48	77	66	11	12	12	49	28	59	72	67	42
18	34	35	21	82	23	17	27	20	13	14	15	19	43	62	35	16	11	24	29	64	14	19	75	36	31
19	28	20	24	33	34	48	14	12	14	14	15	12	11	27	13	17	9	13	10	9	37	17	45	9	20
20	12	17	28	21	31	12	14	13	14	11	16	12	14	14	18	14	21	10	10	12	11	33	35	30	18
21	13	49	36	39	28	28	83	37	12	15	50	66	35	44	22	47	27	41	51	70	20	23	59	58	40
22	39	43	18	46	82	80	65	38	89	17	19	28	37	58	17	10	9	10	8	22	13	14	23	34	34
23	23	18	23	10	12	9	30	26	41	50	81	36	69	52	65	37	12	15	25	24	29	72	42	10	34
24	10	10	10	12	10	12	15	14	15	11	14	21	12	11	9	10	10	11	11	9	10	47	79	46	17
25	26	81	80	36	61	59	55	72	23	30	27	44	79	57	48	40	12	10	17	11	14	49	53	22	42
26	53	35	36	24	29	17	14	11	12	13	13	11	26	42	17	17	10	17	19	20	51	55	20	16	24
27	12	13	9	49	46	26	31	49	69	33	56	30	30	27	20	18	23	19	52	19	19	11	13	64	31
28	55	54	84	40	18	28	10	21	12	16	26	36	29	26	34	69	44	40	21	29	16	30	27	18	33
29	15	12	14	10	15	78	64	28	23	15	20	22	28	29	25	59	38	32	18	26	13	16	33	20	27
30	17	23	46	55	72	58	61	15	11	14	20	18	11	10	12	12	12	10	14	17	13	22	20	18	24
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AVG.	30	29	30	32	31	32	31	29	28	27	32	28	28	31	25	27	20	20	25	28	27	29	31	33	

BISON ENGINEERING INC.
HELENA, MONTANA

JULY 1991

*** WIND SPEED SUMMARY ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	13.0	13.0	15.0	13.0	12.0	10.0	10.0	16.0	18.0	18.0	16.0	17.0	17.0	17.0	16.0	16.0	16.0	16.0	13.0	8.0	6.0	5.0	6.0	2.0	12.9
2	8.0	7.0	3.0	3.0	4.0	5.0	5.0	6.0	9.0	6.0	6.0	6.0	12.0	10.0	8.0	8.0	7.0	8.0	6.0	3.0	9.0	9.0	5.0	1.0	6.4
3	2.0	3.0	4.0	4.0	4.0	4.0	8.0	11.0	11.0	12.0	12.0	12.0	11.0	10.0	13.0	12.0	7.0	5.0	7.0	6.0	5.0	6.0	9.0	12.0	7.9
4	12.0	8.0	3.0	4.0	5.0	10.0	13.0	13.0	10.0	10.0	13.0	13.0	12.0	18.0	19.0	16.0	15.0	14.0	16.0	21.0	20.0	15.0	15.0	10.0	12.7
5	13.0	14.0	10.0	5.0	6.0	8.0	5.0	4.0	4.0	4.0	5.0	6.0	7.0	10.0	10.0	15.0	14.0	11.0	8.0	6.0	6.0	4.0	4.0	6.0	7.7
6	6.0	3.0	1.0	3.0	4.0	4.0	4.0	3.0	5.0	14.0	15.0	13.0	14.0	18.0	21.0	20.0	17.0	14.0	16.0	11.0	7.0	11.0	13.0	15.0	10.5
7	11.0	11.0	7.0	6.0	4.0	5.0	8.0	9.0	16.0	15.0	14.0	14.0	16.0	17.0	16.0	17.0	16.0	16.0	15.0	14.0	11.0	8.0	2.0	1.0	11.2
8	1.0	3.0	5.0	7.0	6.0	8.0	13.0	14.0	11.0	5.0	4.0	5.0	11.0	17.0	19.0	16.0	13.0	11.0	16.0	16.0	13.0	12.0	14.0	14.0	10.6
9	9.0	8.0	4.0	2.0	3.0	5.0	5.0	5.0	4.0	6.0	6.0	6.0	6.0	8.0	9.0	10.0	7.0	8.0	5.0	12.0	7.0	8.0	18.0	14.0	7.3
10	6.0	9.0	10.0	15.0	15.0	6.0	2.0	7.0	8.0	8.0	8.0	11.0	13.0	11.0	15.0	14.0	14.0	12.0	6.0	10.0	9.0	9.0	7.0	5.0	9.6
11	2.0	4.0	5.0	8.0	8.0	3.0	9.0	9.0	7.0	5.0	6.0	11.0	10.0	12.0	12.0	10.0	7.0	7.0	6.0	11.0	13.0	11.0	8.0	4.0	7.8
12	1.0	4.0	6.0	6.0	6.0	3.0	4.0	3.0	3.0	3.0	5.0	7.0	8.0	6.0	5.0	6.0	6.0	6.0	7.0	7.0	6.0	4.0	4.0	3.0	5.0
13	5.0	6.0	7.0	3.0	2.0	2.0	3.0	6.0	7.0	6.0	5.0	6.0	10.0	10.0	7.0	6.0	6.0	8.0	6.0	14.0	7.0	5.0	12.0	9.0	6.6
14	5.0	5.0	2.0	10.0	5.0	5.0	5.0	3.0	10.0	7.0	9.0	8.0	12.0	15.0	11.0	5.0	10.0	17.0	13.0	5.0	6.0	4.0	3.0	4.0	7.5
15	4.0	1.0	1.0	1.0	1.0	2.0	4.0	3.0	5.0	5.0	6.0	8.0	8.0	7.0	7.0	5.0	8.0	10.0	7.0	5.0	5.0	5.0	4.0	5.0	4.9
16	13.0	9.0	4.0	4.0	3.0	3.0	5.0	4.0	8.0	7.0	9.0	10.0	9.0	8.0	12.0	17.0	17.0	16.0	16.0	15.0	9.0	6.0	5.0	4.0	8.9
17	3.0	3.0	3.0	5.0	2.0	2.0	2.0	4.0	5.0	9.0	6.0	7.0	12.0	16.0	22.0	22.0	16.0	17.0	19.0	13.0	16.0	15.0	10.0	6.0	9.8
18	3.0	3.0	6.0	3.0	2.0	2.0	2.0	4.0	7.0	13.0	16.0	15.0	18.0	16.0	17.0	16.0	13.0	12.0	9.0	5.0	3.0	4.0	2.0	1.0	8.0
19	2.0	2.0	4.0	2.0	2.0	1.0	2.0	4.0	3.0	4.0	5.0	10.0	16.0	15.0	15.0	15.0	15.0	12.0	8.0	7.0	10.0	9.0	10.0	8.0	7.5
20	9.0	3.0	3.0	3.0	2.0	2.0	1.0	2.0	5.0	6.0	7.0	7.0	4.0	5.0	6.0	6.0	9.0	9.0	11.0	18.0	24.0	18.0	14.0	19.0	8.0
21	20.0	17.0	16.0	16.0	13.0	14.0	14.0	15.0	16.0	16.0	15.0	12.0	14.0	12.0	12.0	13.0	13.0	11.0	11.0	12.0	8.0	7.0	8.0	9.0	13.1
22	9.0	7.0	6.0	2.0	5.0	9.0	5.0	9.0	11.0	12.0	14.0	16.0	18.0	20.0	20.0	21.0	21.0	20.0	19.0	19.0	18.0	16.0	17.0	14.0	13.7
23	12.0	11.0	10.0	11.0	8.0	7.0	10.0	16.0	15.0	16.0	17.0	18.0	18.0	19.0	20.0	20.0	18.0	19.0	18.0	14.0	12.0	9.0	8.0	8.0	13.9
24	6.0	8.0	8.0	7.0	7.0	8.0	5.0	9.0	14.0	15.0	17.0	19.0	20.0	19.0	20.0	20.0	21.0	20.0	16.0	14.0	11.0	14.0	10.0	6.0	13.1
25	5.0	7.0	6.0	5.0	3.0	2.0	3.0	4.0	5.0	10.0	12.0	9.0	12.0	11.0	11.0	15.0	12.0	9.0	10.0	15.0	10.0	11.0	11.0	10.0	8.7
26	14.0	11.0	10.0	10.0	8.0	7.0	10.0	10.0	10.0	11.0	9.0	8.0	9.0	10.0	12.0	15.0	13.0	11.0	6.0	5.0	3.0	4.0	6.0	3.0	9.0
27	4.0	8.0	4.0	2.0	1.0	4.0	2.0	1.0	4.0	5.0	9.0	12.0	10.0	10.0	12.0	11.0	12.0	11.0	11.0	9.0	7.0	5.0	7.0	3.0	6.8
28	4.0	7.0	4.0	4.0	2.0	4.0	5.0	5.0	4.0	8.0	6.0	10.0	10.0	12.0	13.0	8.0	9.0	12.0	8.0	4.0	7.0	5.0	4.0	2.0	6.5
29	2.0	3.0	4.0	3.0	3.0	4.0	5.0	11.0	10.0	11.0	11.0	8.0	9.0	11.0	9.0	14.0	14.0	20.0	13.0	15.0	11.0	7.0	7.0	12.0	9.0
30	10.0	4.0	4.0	3.0	7.0	5.0	6.0	7.0	5.0	5.0	5.0	11.0	18.0	19.0	19.0	16.0	14.0	11.0	13.0	10.0	8.0	8.0	3.0	5.0	9.0
31	4.0	6.0	3.0	1.0	1.0	4.0	9.0	10.0	8.0	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.4
AVG.	7.0	6.7	5.7	5.5	5.0	5.1	5.9	7.3	8.3	9.0	9.6	10.5	12.1	13.0	13.6	13.5	12.7	12.4	11.2	10.8	9.6	8.5	8.2	7.2	

# of Valid Hours = 730 % Data Completeness = 98.1

BISON ENGINEERING INC.
HELENA, MONTANA

JULY 1991

*** WIND DIRECTION SUMMARY ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	261	264	276	237	227	252	252	271	269	258	250	250	257	267	274	271	270	270	265	249	221	190	233	257	257.4
2	227	233	154	102	96	65	62	212	216	70	30	337	243	251	352	288	288	350	332	320	76	49	45	87	299.9
3	232	180	15	25	50	97	203	221	218	204	233	254	255	249	257	252	289	323	266	225	198	220	234	243	328.5
4	255	242	41	189	78	226	230	223	219	217	253	259	253	269	278	275	276	262	267	207	212	224	219	221	218.5
5	216	231	236	216	247	248	207	216	37	97	114	247	277	291	261	280	273	274	260	266	14	250	206	210	211.4
6	218	16	19	211	215	191	214	100	88	257	260	259	264	266	279	280	276	352	11	54	59	66	23	11	250.1
7	8	336	324	5	96	108	26	58	66	61	63	56	56	61	55	58	62	64	54	53	50	53	151	15	27.2
8	310	196	187	210	226	233	230	232	237	297	29	115	244	292	298	309	336	19	68	77	77	83	84	76	48.5
9	18	357	15	266	235	205	226	218	60	36	56	86	118	119	111	46	64	79	92	67	74	121	218	208	66.5
10	134	223	237	244	258	264	58	211	210	220	267	268	245	252	276	270	279	270	289	95	57	79	42	34	72.2
11	63	198	212	235	236	7	239	248	257	333	78	252	266	279	252	263	267	250	355	71	85	57	43	6	83.1
12	255	192	205	224	215	75	54	70	43	73	58	42	41	56	81	65	52	45	53	43	7	76	205	200	103.4
13	223	211	225	258	41	57	46	41	27	33	145	117	52	36	87	118	97	96	36	335	208	358	278	96	125.5
14	230	186	51	217	12	288	222	213	194	149	39	37	273	274	231	78	136	226	346	80	262	350	58	184	134.5
15	307	190	24	22	92	14	69	65	239	207	222	291	309	297	278	252	50	73	41	34	34	348	195	11	133.3
16	83	19	12	227	203	190	238	118	53	35	33	29	44	357	51	94	78	66	67	79	91	357	28	173	74.3
17	197	165	18	279	219	10	40	63	149	280	270	236	247	207	204	205	233	215	211	284	348	318	267	301	222.9
18	54	278	337	255	202	183	159	67	272	283	288	271	270	269	266	264	264	269	243	262	296	195	211	22	274.6
19	168	190	208	192	347	42	78	80	95	164	134	281	272	277	276	271	271	261	247	201	112	51	72	44	238.3
20	20	84	178	348	144	1	9	59	34	30	32	24	39	172	159	187	90	99	176	189	196	201	233	227	158.8
21	207	211	210	213	228	215	211	207	212	213	199	214	290	283	255	265	274	301	349	32	53	35	49	41	214.1
22	59	13	7	83	25	7	8	56	73	68	62	55	50	51	56	61	62	64	63	70	71	63	61	63	60.9
23	75	74	58	63	23	15	37	66	50	50	59	51	57	60	63	62	70	71	70	63	67	62	47	56	65.2
24	4	5	2	353	1	355	15	51	65	62	61	59	57	58	61	60	57	62	73	70	72	83	78	103	64.7
25	186	225	218	205	57	35	34	72	52	201	197	206	203	205	208	193	210	333	239	245	229	238	224	207	189.1
26	208	238	235	233	231	234	234	230	214	211	234	250	249	292	259	277	280	287	307	324	249	69	53	43	237.7
27	197	217	161	52	20	12	41	117	312	79	290	242	226	266	272	276	247	264	272	277	213	191	211	262	255.7
28	235	208	101	40	38	51	55	55	218	216	197	199	263	259	288	280	238	264	273	225	225	212	239	87	242.0
29	75	166	18	103	50	57	218	223	219	218	207	187	228	249	214	271	252	194	199	196	236	14	209	242	212.1
30	231	267	216	352	209	212	209	224	183	77	111	262	281	290	284	287	283	251	219	219	204	215	10	240	266.7
31	189	225	57	29	84	89	223	228	232	214	-	-	-	-	-	-	-	-	-	-	-	-	-	-	218.5

# of Valid Hours = 730 % Data Completeness = 98.1

BISON ENGINEERING INC.
HELENA, MONTANA

JULY 1991

*** *WIND FREQUENCY SUMMARY* ***

DIR---> / SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.0 - 4.0	1.1	2.5	2.7	2.9	2.1	0.5	0.1	1.1	1.5	2.5	1.4	1.0	0.5	0.1	0.5	0.3	20.8
4.0 - 7.5	1.5	2.5	2.6	1.8	1.0	1.1	0.4	0.4	1.1	3.2	3.4	1.1	1.5	1.0	0.5	0.7	23.7
7.5 - 12.1	1.2	1.2	3.4	3.0	1.0	0.5	0.1	0.0	0.3	2.7	5.6	5.3	3.7	1.1	0.1	0.4	29.9
12.1 - 19.0	0.4	0.1	1.4	5.1	0.7	0.0	0.0	0.0	0.1	2.2	2.3	2.1	6.0	1.5	0.3	0.5	22.7
19.0 - 24.7	0.0	0.0	0.3	1.4	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.3	0.0	0.0	0.0	2.9
24.7 - 30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0 - 40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0 - 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	4.2	6.3	10.4	14.1	4.7	2.2	0.7	1.5	3.0	11.5	12.7	9.5	12.1	3.7	1.5	1.9	
AVG. SPEED	6.7	5.4	7.9	11.4	6.5	5.6	5.6	3.7	5.1	9.5	8.9	10.1	12.3	11.0	6.7	8.6	

Calm Hours = 0.0% Total Hours With Both Speed and Direction = 730 Average Wind Speed = 9.1 (MPH)

Resultant Windspeed = 1.5 (MPH) Resultant Wind Direction = 258.6 Deg Wind Persistance = 16.2 %

BISON ENGINEERING INC.
HELENA, MONTANA

AUGUST 1991

*** WIND SPEED SUMMARY ***

DAY	HOURS																							AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	4.0	6.0	10.0	5.0	5.0	5.0	7.0	10.0	11.0	12.0	12.0	15.0	12.0	10.0	8.9
14	7.0	11.0	15.0	9.0	4.0	4.0	3.0	4.0	6.0	5.0	6.0	11.0	11.0	10.0	11.0	12.0	13.0	9.0	7.0	12.0	12.0	16.0	17.0	11.0	9.4
15	6.0	4.0	2.0	4.0	2.0	2.0	2.0	2.0	2.0	5.0	5.0	5.0	5.0	11.0	15.0	15.0	14.0	16.0	18.0	17.0	13.0	8.0	8.0	4.0	7.7
16	2.0	2.0	4.0	4.0	2.0	3.0	4.0	3.0	7.0	4.0	6.0	7.0	12.0	14.0	16.0	13.0	9.0	6.0	11.0	11.0	10.0	7.0	7.0	5.0	7.0
17	3.0	5.0	6.0	4.0	1.0	2.0	3.0	3.0	3.0	5.0	6.0	4.0	5.0	6.0	11.0	10.0	14.0	13.0	10.0	11.0	13.0	7.0	6.0	7.0	6.6
18	6.0	5.0	4.0	5.0	5.0	5.0	3.0	9.0	14.0	6.0	4.0	5.0	7.0	11.0	7.0	6.0	7.0	4.0	7.0	5.0	5.0	4.0	2.0	3.0	5.8
19	3.0	3.0	3.0	1.0	4.0	3.0	5.0	11.0	12.0	13.0	14.0	12.0	13.0	14.0	11.0	9.0	12.0	12.0	17.0	12.0	15.0	14.0	14.0	19.0	10.3
20	20.0	19.0	18.0	14.0	15.0	14.0	16.0	17.0	16.0	14.0	15.0	16.0	17.0	17.0	16.0	15.0	15.0	14.0	9.0	7.0	9.0	8.0	7.0	8.0	14.0
21	10.0	11.0	13.0	12.0	12.0	13.0	12.0	13.0	12.0	12.0	10.0	14.0	15.0	15.0	15.0	14.0	13.0	11.0	6.0	5.0	15.0	14.0	11.0	10.0	12.0
22	11.0	11.0	13.0	12.0	16.0	10.0	14.0	10.0	10.0	11.0	11.0	13.0	15.0	16.0	14.0	13.0	16.0	8.0	4.0	4.0	24.0	9.0	10.0	15.0	12.1
23	13.0	9.0	13.0	9.0	13.0	10.0	6.0	7.0	11.0	14.0	14.0	12.0	13.0	13.0	12.0	13.0	7.0	5.0	11.0	7.0	7.0	8.0	4.0	6.0	9.9
24	9.0	6.0	3.0	6.0	5.0	2.0	1.0	3.0	3.0	4.0	4.0	6.0	5.0	6.0	6.0	10.0	6.0	8.0	8.0	11.0	12.0	12.0	10.0	6.0	6.3
25	4.0	4.0	4.0	6.0	10.0	6.0	13.0	17.0	21.0	22.0	20.0	23.0	25.0	22.0	20.0	22.0	17.0	15.0	7.0	8.0	7.0	8.0	7.0	14.0	13.4
26	10.0	10.0	4.0	3.0	4.0	4.0	5.0	9.0	8.0	13.0	17.0	17.0	15.0	13.0	9.0	8.0	19.0	13.0	9.0	3.0	8.0	10.0	17.0	14.0	10.1
27	17.0	21.0	14.0	7.0	11.0	19.0	16.0	12.0	6.0	9.0	15.0	14.0	10.0	8.0	7.0	9.0	12.0	6.0	11.0	11.0	6.0	16.0	12.0	18.0	12.0
28	12.0	13.0	17.0	18.0	17.0	15.0	18.0	17.0	12.0	14.0	12.0	12.0	14.0	12.0	11.0	13.0	17.0	18.0	17.0	18.0	18.0	14.0	15.0	12.0	14.8
29	14.0	10.0	11.0	9.0	13.0	18.0	16.0	15.0	11.0	10.0	12.0	11.0	11.0	13.0	11.0	10.0	8.0	6.0	3.0	3.0	1.0	3.0	3.0	5.0	9.5
30	3.0	5.0	4.0	5.0	5.0	6.0	6.0	5.0	9.0	9.0	9.0	6.0	5.0	6.0	6.0	9.0	8.0	6.0	4.0	5.0	5.0	4.0	4.0	3.0	5.7
31	3.0	4.0	3.0	2.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	4.0	6.0	10.0	13.0	10.0	7.0	6.0	3.0	9.0	16.0	9.0	9.0	6.3
AVG.	8.5	8.5	8.4	7.2	8.0	7.8	8.2	9.0	9.3	9.7	9.9	10.4	11.2	11.5	11.2	11.5	11.8	9.8	9.3	8.7	10.6	10.2	9.2	9.4	

# of Valid Hours = 446 % Data Completeness = 59.9

BISON ENGINEERING INC.
HELENA, MONTANA

AUGUST 1991

*** WIND DIRECTION SUMMARY ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	169	187	171	230	313	282	204	89	84	81	79	84	92	107	109.2
14	208	252	252	341	296	198	144	97	75	19	30	67	79	79	56	181	209	204	159	90	95	93	82	89	89.6
15	22	350	25	190	31	1	54	112	99	55	67	49	119	247	285	279	267	83	85	80	69	29	14	108	318.9
16	151	104	230	112	277	60	278	120	207	205	34	52	255	279	265	257	241	62	65	84	89	46	19	358	276.9
17	209	199	220	262	94	76	32	89	138	194	227	140	80	56	286	218	214	203	190	180	180	196	233	240	290.5
18	241	235	16	32	2	28	5	196	206	210	91	90	177	182	235	122	38	40	257	205	195	178	206	57	311.5
19	360	73	19	9	58	48	149	220	216	204	205	221	248	250	252	255	251	256	249	212	228	207	224	215	278.9
20	221	217	218	217	217	220	218	215	209	211	255	272	274	265	262	264	267	283	258	228	210	248	226	230	269.1
21	239	245	250	247	248	249	232	210	210	205	234	291	271	280	285	291	301	314	309	230	225	229	232	219	253.4
22	225	220	214	208	206	215	191	206	218	208	209	244	255	274	311	318	285	253	206	197	186	208	209	206	249.4
23	227	243	218	198	225	217	263	158	204	199	216	212	197	200	196	236	235	53	329	49	335	16	306	216	294.7
24	242	224	281	219	187	19	208	148	138	88	241	57	302	57	10	284	24	52	65	58	61	78	63	31	328.2
25	211	235	7	25	52	72	219	211	205	203	202	199	200	205	223	259	264	272	261	68	87	64	50	273	318.0
26	241	265	38	14	12	26	32	258	221	213	207	213	216	258	248	265	269	223	204	238	223	205	234	203	249.3
27	208	222	228	262	219	205	224	219	205	208	187	181	185	169	133	165	267	44	122	210	232	208	229	252	222.8
28	265	266	268	259	254	274	272	268	251	224	219	259	267	244	269	229	219	206	206	204	207	207	204	206	246.8
29	201	207	218	211	221	215	211	223	219	193	210	211	212	208	198	190	224	208	263	226	105	305	21	12	212.4
30	21	5	3	12	34	62	173	45	195	219	239	231	166	202	175	267	329	358	16	217	206	229	78	29	335.4
31	77	35	9	46	91	40	16	42	44	33	229	276	130	140	60	73	68	70	29	229	228	255	224	254	62.3

# of Valid Hours = 446 % Data Completeness = 59.9

BISON ENGINEERING INC.
HELENA, MONTANA

AUGUST 1991

*** *WIND FREQUENCY SUMMARY* ***

DIR---> / SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.0 - 4.0	1.8	3.1	1.3	1.6	1.3	1.3	1.1	0.7	0.4	1.8	1.1	0.4	1.3	0.2	0.4	0.0	18.2
4.0 - 7.5	1.1	3.6	3.1	1.8	0.9	0.4	0.4	0.9	1.1	2.9	3.8	0.7	0.7	0.4	0.4	0.2	22.6
7.5 - 12.1	0.0	0.7	0.7	3.1	2.0	0.4	0.0	0.4	1.6	6.5	5.8	5.6	1.3	0.4	0.2	0.7	29.6
12.1 - 19.0	0.0	0.0	0.0	0.4	1.3	0.0	0.0	0.0	0.9	7.4	6.5	3.4	5.2	1.6	0.4	0.0	27.1
19.0 - 24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.1	0.7	0.2	0.0	0.0	0.0	0.0	2.2
24.7 - 30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
30.0 - 40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0 - 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2.9	7.4	5.2	7.0	5.6	2.2	1.6	2.0	4.3	20.0	17.9	10.3	8.5	2.7	1.6	0.9	
AVG. SPEED	3.9	4.8	5.7	7.7	9.6	4.8	4.3	5.6	10.1	11.6	11.0	11.5	12.2	11.3	8.0	8.8	

Calm Hours = 0.0% Total Hours With Both Speed and Direction = 446 Average Wind Speed = 9.6 (MPH)

Resultant Windspeed = 4.8 (MPH) Resultant Wind Direction = 223.0 Deg Wind Persistance = 49.8 %

BISON ENGINEERING INC.
HELENA, MONTANA

SEPTEMBER 1991

*** WIND SPEED SUMMARY ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	11.0	9.0	8.0	10.0	9.0	9.0	15.0	13.0	13.0	14.0	13.0	16.0	16.0	13.0	10.0	10.0	10.0	7.0	19.0	16.0	10.0	12.0	14.0	5.0	11.8
2	8.0	4.0	8.0	5.0	4.0	1.0	4.0	4.0	4.0	5.0	5.0	11.0	17.0	19.0	21.0	21.0	21.0	18.0	8.0	8.0	4.0	8.0	7.0	10.0	9.4
3	9.0	8.0	10.0	9.0	9.0	8.0	4.0	3.0	3.0	3.0	5.0	5.0	6.0	7.0	7.0	7.0	6.0	5.0	7.0	6.0	5.0	3.0	4.0	2.0	5.9
4	1.0	3.0	1.0	1.0	2.0	2.0	2.0	2.0	3.0	4.0	5.0	5.0	5.0	4.0	5.0	6.0	4.0	3.0	5.0	5.0	7.0	12.0	12.0	14.0	4.7
5	11.0	9.0	9.0	9.0	6.0	1.0	3.0	4.0	3.0	6.0	6.0	7.0	8.0	10.0	10.0	10.0	11.0	8.0	5.0	5.0	3.0	6.0	4.0	3.0	6.5
6	3.0	2.0	3.0	3.0	5.0	5.0	3.0	5.0	13.0	10.0	5.0	4.0	5.0	4.0	4.0	4.0	3.0	5.0	3.0	5.0	3.0	2.0	5.0	3.0	4.5
7	2.0	4.0	3.0	2.0	4.0	3.0	3.0	1.0	3.0	2.0	2.0	8.0	20.0	16.0	11.0	6.0	6.0	5.0	4.0	2.0	3.0	3.0	4.0	5.0	5.1
8	3.0	3.0	1.0	2.0	3.0	14.0	18.0	6.0	2.0	4.0	3.0	9.0	14.0	4.0	7.0	5.0	6.0	3.0	6.0	9.0	9.0	10.0	11.0	11.0	6.8
9	10.0	9.0	10.0	10.0	11.0	12.0	14.0	16.0	17.0	16.0	17.0	18.0	17.0	17.0	18.0	16.0	15.0	14.0	12.0	11.0	11.0	10.0	11.0	10.0	13.4
10	5.0	8.0	6.0	5.0	5.0	6.0	5.0	4.0	4.0	3.0	7.0	6.0	7.0	10.0	7.0	5.0	12.0	12.0	6.0	5.0	8.0	10.0	9.0	7.0	6.8
11	7.0	11.0	9.0	5.0	4.0	6.0	5.0	7.0	6.0	5.0	5.0	8.0	7.0	7.0	6.0	8.0	12.0	10.0	7.0	5.0	5.0	11.0	11.0	11.0	7.4
12	9.0	13.0	13.0	15.0	13.0	12.0	12.0	13.0	13.0	13.0	11.0	9.0	8.0	7.0	7.0	9.0	9.0	9.0	7.0	3.0	5.0	5.0	6.0	7.0	9.5
13	7.0	9.0	11.0	12.0	13.0	13.0	15.0	18.0	17.0	20.0	18.0	14.0	13.0	10.0	10.0	10.0	11.0	10.0	18.0	18.0	11.0	8.0	8.0	12.0	12.8
14	12.0	10.0	9.0	11.0	10.0	10.0	11.0	12.0	11.0	15.0	9.0	8.0	13.0	14.0	16.0	12.0	6.0	7.0	10.0	12.0	12.0	12.0	11.0	11.0	11.0
15	12.0	12.0	12.0	10.0	10.0	9.0	9.0	8.0	13.0	15.0	14.0	14.0	13.0	15.0	15.0	12.0	14.0	11.0	10.0	11.0	11.0	12.0	15.0	12.0	12.0
16	13.0	15.0	16.0	17.0	17.0	17.0	13.0	14.0	14.0	14.0	9.0	7.0	8.0	11.0	10.0	9.0	5.0	7.0	12.0	8.0	6.0	7.0	3.0	2.0	10.6
17	3.0	2.0	3.0	5.0	4.0	4.0	5.0	3.0	4.0	3.0	7.0	7.0	7.0	4.0	3.0	5.0	10.0	9.0	9.0	6.0	7.0	5.0	3.0	2.0	5.0
18	3.0	3.0	4.0	3.0	7.0	7.0	9.0	10.0	12.0	13.0	11.0	7.0	4.0	3.0	4.0	5.0	6.0	4.0	3.0	4.0	4.0	4.0	2.0	4.0	5.7
19	4.0	4.0	3.0	4.0	4.0	10.0	15.0	15.0	13.0	13.0	12.0	13.0	11.0	10.0	14.0	12.0	11.0	8.0	8.0	8.0	5.0	8.0	6.0	10.0	9.2
20	10.0	10.0	8.0	12.0	9.0	17.0	14.0	18.0	24.0	22.0	18.0	16.0	14.0	14.0	12.0	10.0	10.0	11.0	13.0	17.0	18.0	11.0	12.0	8.0	13.7
21	17.0	10.0	7.0	9.0	8.0	7.0	5.0	5.0	6.0	7.0	6.0	8.0	11.0	8.0	12.0	6.0	8.0	10.0	5.0	6.0	8.0	9.0	5.0	3.0	7.8
22	3.0	3.0	5.0	4.0	2.0	2.0	3.0	3.0	4.0	10.0	11.0	9.0	6.0	7.0	13.0	15.0	16.0	13.0	16.0	13.0	9.0	7.0	11.0	9.0	8.1
23	9.0	10.0	11.0	16.0	14.0	11.0	10.0	9.0	6.0	5.0	4.0	7.0	4.0	7.0	8.0	10.0	14.0	9.0	5.0	6.0	6.0	5.0	6.0	11.0	8.5
24	12.0	11.0	10.0	10.0	9.0	11.0	13.0	14.0	13.0	13.0	13.0	13.0	19.0	19.0	19.0	18.0	16.0	12.0	8.0	10.0	11.0	9.0	4.0	5.0	12.2
25	6.0	5.0	3.0	4.0	4.0	3.0	3.0	5.0	5.0	4.0	4.0	4.0	3.0	4.0	4.0	6.0	10.0	10.0	9.0	7.0	8.0	4.0	4.0	3.0	5.1
26	4.0	5.0	5.0	11.0	12.0	15.0	15.0	17.0	17.0	16.0	12.0	13.0	8.0	5.0	6.0	7.0	10.0	7.0	6.0	6.0	5.0	4.0	5.0	5.0	9.0
27	5.0	6.0	8.0	7.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	5.0	6.0	7.0	8.0	7.0	6.0	7.0	3.0	4.0	6.0	5.0	7.0	3.0	4.8
28	3.0	3.0	5.0	5.0	9.0	8.0	17.0	15.0	16.0	15.0	13.0	14.0	10.0	15.0	11.0	5.0	6.0	5.0	8.0	7.0	13.0	14.0	8.0	11.0	9.8
29	11.0	10.0	10.0	12.0	9.0	6.0	2.0	7.0	7.0	9.0	9.0	10.0	8.0	9.0	8.0	10.0	7.0	6.0	9.0	6.0	7.0	4.0	5.0	5.0	7.8
30	7.0	6.0	3.0	3.0	2.0	2.0	6.0	15.0	17.0	17.0	15.0	13.0	19.0	18.0	14.0	14.0	15.0	11.0	10.0	13.0	15.0	15.0	16.0	17.0	11.8
AVG.	7.3	7.2	7.1	7.7	7.3	7.8	8.5	8.9	9.5	9.9	9.1	9.6	10.2	9.9	10.0	9.3	9.9	8.5	8.4	8.1	7.8	7.8	7.6	7.4	

# of Valid Hours = 720 % Data Completeness = 100.0

BISON ENGINEERING INC.
HELENA, MONTANA

SEPTEMBER 1991

*** *WIND DIRECTION SUMMARY* ***

DAY	HOURS																								AVG.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	253	251	242	248	240	235	218	248	215	211	220	199	197	196	205	236	202	216	194	209	262	249	233	214	222.6
2	242	276	245	291	302	24	242	223	173	109	192	257	256	265	281	280	276	275	29	65	50	58	348	60	261.9
3	51	34	33	25	23	13	172	334	354	37	6	30	26	39	43	39	46	41	52	33	336	188	209	32	28.6
4	187	27	10	13	20	24	352	108	61	52	56	28	27	63	67	46	84	145	37	18	23	88	89	76	49.8
5	48	33	16	10	21	157	193	193	165	42	45	37	42	43	53	46	45	33	13	346	177	225	214	225	44.5
6	14	41	27	21	40	56	36	165	220	231	295	161	80	115	73	78	74	127	42	11	208	217	198	31	62.1
7	182	21	299	197	211	83	28	329	176	142	89	50	64	55	47	36	345	354	20	297	176	5	218	195	60.2
8	210	64	323	39	3	242	257	187	294	172	133	94	245	245	349	11	338	61	42	21	5	21	38	64	60.1
9	31	11	19	27	56	68	75	71	67	62	67	65	58	61	60	58	61	60	62	63	66	63	68	64	66.2
10	53	72	46	74	16	284	75	61	78	12	48	60	66	55	56	68	67	156	230	214	199	199	207	174	67.4
11	184	216	183	188	250	215	258	228	307	31	356	277	329	260	271	286	266	269	243	222	217	247	226	214	264.8
12	224	208	198	198	199	193	193	196	203	203	204	201	207	215	277	278	274	274	231	243	228	222	221	254	239.5
13	238	225	215	217	216	215	211	212	229	207	207	205	207	215	233	241	191	192	244	263	237	267	219	327	232.0
14	347	287	279	220	244	238	224	241	223	263	351	187	338	332	337	347	312	264	242	233	235	237	235	232	289.3
15	233	232	224	223	222	235	229	226	219	223	233	239	238	259	242	235	247	235	235	231	230	222	216	225	229.5
16	219	223	222	224	211	211	223	208	210	218	222	228	236	254	273	275	113	13	34	45	22	31	116	107	218.5
17	330	59	92	56	88	53	236	251	79	118	43	71	59	66	255	111	-	-	347	66	57	7	118	180	78.9
18	231	179	218	273	238	234	242	235	225	222	220	215	226	319	138	44	46	29	14	248	212	217	138	-	215.6
19	23	4	11	50	60	220	236	223	219	230	231	210	202	210	263	268	259	247	210	211	221	235	250	250	232.2
20	247	235	231	209	225	200	206	210	212	201	212	201	202	206	203	206	215	207	200	202	205	271	226	254	205.6
21	269	327	46	56	317	22	79	203	356	-	39	92	307	16	329	188	2	35	157	273	305	301	259	108	326.2
22	143	40	358	349	300	319	166	188	20	202	198	184	205	270	279	275	269	270	273	260	234	231	210	209	269.9
23	222	231	239	247	251	254	283	309	303	284	223	359	346	262	282	260	254	261	223	208	223	341	234	244	278.6
24	245	245	242	240	247	245	230	221	227	218	219	233	271	262	261	257	258	261	242	249	248	251	207	201	252.8
25	222	126	331	206	85	338	336	137	57	45	28	52	87	109	105	218	241	243	213	201	231	191	44	44	139.3
26	124	74	178	221	221	233	231	224	219	226	232	232	245	-	51	69	73	62	21	354	44	292	209	221	218.8
27	219	204	222	213	41	20	40	60	100	91	45	15	34	61	45	51	80	72	19	211	210	217	228	83	76.0
28	67	41	243	119	215	183	233	224	221	207	228	227	239	223	244	308	27	255	218	247	264	259	226	229	231.3
29	220	230	236	251	251	317	119	204	246	214	214	206	206	249	201	284	51	67	65	41	21	7	27	92	237.5
30	54	56	26	231	331	276	233	222	218	217	230	236	255	261	250	251	246	249	243	253	237	239	245	241	245.2

# of Valid Hours = 715 % Data Completeness = 99.3

BISON ENGINEERING INC.
HELENA, MONTANA

SEPTEMBER 1991

*** *WIND FREQUENCY SUMMARY* ***

DIR---> / SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.0 - 4.0	1.3	3.1	2.5	2.1	1.4	1.5	0.8	0.6	1.8	1.7	1.4	1.0	0.4	0.8	0.4	1.3	21.9
4.0 - 7.5	1.7	2.9	4.6	2.5	0.4	0.6	0.4	0.3	0.8	2.1	3.9	1.5	1.0	0.7	0.6	1.1	25.0
7.5 - 12.1	1.0	2.2	2.2	2.1	0.6	0.0	0.0	0.1	0.7	4.2	8.6	6.5	2.2	0.8	0.6	0.8	32.6
12.1 - 19.0	0.0	0.0	0.1	1.8	0.0	0.0	0.0	0.0	0.0	4.7	6.4	3.6	2.4	0.0	0.0	0.4	19.4
19.0 - 24.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.0	1.0
24.7 - 30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0 - 40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0 - 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	3.9	8.2	9.4	8.6	2.4	2.1	1.3	1.0	3.3	13.1	20.3	12.6	6.4	2.4	1.5	3.6	
AVG. SPEED	5.6	5.6	6.3	8.7	5.1	3.6	3.6	4.7	5.0	10.7	10.3	10.6	12.0	5.8	5.9	7.1	

Calm Hours = 0.0% Total Hours With Both Speed and Direction = 720 Average Wind Speed = 8.5 (MPH)

Resultant Windspeed = 3.3 (MPH) Resultant Wind Direction = 236.4 Deg Wind Persistance = 38.8 %

BISON ENGINEERING INC
HELENA, MONTANA

Envircon Livingston, Montana 4th Q 1991

*** *WIND FREQUENCY SUMMARY* ***

DIR---> / SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.0 - 4.0	1.3	2.8	2.3	2.3	1.6	1.1	0.6	0.8	1.4	2.0	1.3	0.8	0.7	0.4	0.5	0.6	20.6
4.0 - 7.5	1.5	2.9	3.5	2.1	0.7	0.7	0.4	0.5	1.0	2.7	3.7	1.2	1.1	0.7	0.5	0.7	23.9
7.5 - 12.1	0.8	1.5	2.3	2.7	1.1	0.3	0.1	0.2	0.7	4.2	6.8	5.9	2.6	0.8	0.3	0.6	30.9
12.1 - 19.0	0.2	0.1	0.6	2.7	0.6	0.0	0.0	0.0	0.3	4.4	4.9	3.0	4.4	0.9	0.2	0.4	22.5
19.0 - 24.7	0.0	0.0	0.1	0.6	0.0	0.0	0.0	0.0	0.1	0.8	0.2	0.1	0.3	0.0	0.0	0.0	2.0
24.7 - 30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
30.0 - 40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0 - 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	3.8	7.3	8.8	10.3	4.0	2.2	1.1	1.4	3.4	14.1	16.8	10.9	9.1	3.0	1.5	2.3	
AVG. SPEED	5.8	5.4	6.9	10.0	7.2	4.7	4.3	4.6	6.5	10.6	10.1	10.6	12.2	9.5	6.7	7.7	

Calm Hours = 0.0% Total Hours With Both Speed and Direction = 1896 Average Wind Speed = 9.0 (MPH)

Resultant Windspeed = 2.9(MPH) Resultant Wind Direction = 235.5Deg Wind Persistance = 32.0 %

APPENDIX B

ENVIROCON, INC.

B I S O N E N G I N E E R I N G I N C

Helena, Montana

PM-10 Calibration - Wedding Assoc.

Calibrated by Dan McCaffery Location Liv/BN Downwind

Date 7/31/91 Sampler # 024090111 4 U

Look-up :

20" U-Tube Manometer: 23.7 " Water = delta

Barometric Pressire : 25.28 " Mercury = PO

Temperature: 304.4 °K 31.2°C

P1/PO = ~~23.54 DM.~~ 0.931 {P1=PO - delta/13.6 = 25.54

Look-up = 40.1 = Look-ACFM

Look-SCFM = ~~DM 36.47~~ 33.17 (std ft^3/min)

= ACFM[PO*298]/29.92*Tk] Tk=temp degrees K

Orifice: #548-ECON

10 " Manometer 4.0 " (Clean Filter)

$Q = .5367 (dP)^{.50378}$

= 1.079 (m^3/min)

Qcfm = Q*35.314

= 38.105 (acfm)r

$Qscfm = Qcfm[(PO*298)/(29.92*Tk)]^{0.5}$

= 34.66 ~~scfm~~

% Difference: 4.3 %

Adjustment: NA (if necessary)

Clean Filter Transducer: _____ acfm

B I S O N E N G I N E E R I N G I N C

Helena, Montana

PM-10 Calibration - Wedding Assoc.

Calibrated by Dan McCaffery Location Liv/BN Upwind

Date 7/31/91 Sampler # 0240901115U

Look-up :

20" U-Tube Manometer: 23.8 " Water = delta

Barometric Pressire : 25.28 " Mercury = PO

Temperature: 304.4 °K 31.2°C

P1/PO = ~~0.731 = 3.55 DM~~ 0.731 (P1=PO - delta/13.6

Look-up = 40.26 = Look-ACFM

Look-SCFM = 33.30 (std ft^3/min)

= ACFM[PO*298]/29.92*Tk] Tk=temp degrees K

Orifice: #548-ECON

10 " Manometer 4.0 " (Clean Filter)

$Q = .5367\,(dP)^{.50378}$

= 1.079 (m^3/min)

Qcfm = Q*35.314

= 38.105 (acfm)r

$Qscfm = Qcfm[(PO*298)/(29.92*Tk)]^{0.5}$

= 34.66

% Difference: 3.9 %

Adjustment: NA (if necessary)

Clean Filter Transducer: _____ acfm

B I S O N E N G I N E E R I N G I N C

Helena, Montana

PM-10 Calibration - Wedding Assoc.

Calibrated by Dan McCaffery Location Liv/BN upwind

Date 7/31/91 Sampler # 9240901115*1

Look-up :

20" U-Tube Manometer: 23.7(c) DM 23.8 (sum) " Water = delta

Barometric Pressire : 25.28 " Mercury = PO

Temperature: _____ °K 31.2°C

P1/PO = _____ (P1=PO - delta/13.6

Look-up = _____ = Look-ACFM

Look-SCFM = _____ (std ft^3/min)

= ACFM[PO*298]/29.92*Tk] Tk=temp degrees K

Orifice: =548-ECON

10 " Manometer 4.0 p.m. " wc(Clean Filter)

$Q = .5367(dP)^{.50378}$

= _____ (m^3/min)

Qcfm = Q*35.314

= _____ (acfm)r

$Qscfm = Qcfm[(PO*298)/(29.92*Tk)]^{0.5}$

= _____

% Difference: _____ %

Adjustment: _____ (if necessary)

Clean Filter Transducer: _____ acfm

B I S O N E N G I N E E R I N G I N C

Helena, Montana

PM-10 Calibration - Wedding Assoc.

Calibrated by Dan McCaffery Location Lir./BN Downwind

Date 7/31/91 Sampler # 0240901114 U

Look-up :

20" U-Tube Manometer: 22.8(i)/23.7(run) " Water = delta

Barometric Pressire : 25.28 " Mercury = PO

Temperature: _____ °K 31.2°C

P1/PO = _____ (P1=PO - delta/13.6

Look-up = _____ = Look-ACFM

Look-SCFM = _____ (std ft^3/min)

= ACFM[PO*298]/29.92*Tk] Tk=temp degrees K

Orifice: #548-ECON

10 " Manometer 1/8 0(run)" (Clean Filter)

$Q = .5367\ (dP)^{.50378}$

= _____ (m^3/min)

Qcfm = Q*35.314

= _____ (acfm)r

$Qscfm = Qcfm[(PO*298)/(29.92*Tk)]^{0.5}$

= _____

% Difference: _____ %

Adjustment: _____ (if necessary)

Clean Filter Transducer: _____ acfm

B I S O N E N G I N E E R I N G I N C

Helena, Montana

PM-10 Auditing - Wedding Assoc.

Audited by Jack Dartman Location Livingston Railyard

Date 9-18-91 Sampler # Upwind Site

Look-up :

P1/P0 = .939 (from previous calibration)

Temperature: 284 (degrees K)

Look-up = 39.648 = Look-ACFM

Look-SCFM = 35.568 (std ft^3/min)

= ACFM[P0*298]/29.92*Tk] Tk=temp degrees K

Audit Orifice

10 " Manometer 2.8 " (Clean Filter)

$$Q = .62283\ (dP)^{.48645}$$

= 1.042 (m^3/min)

Qcfm = Q*35.314

= 36.795 (acfm)r

$$Qscfm = Qcfm[(P0*298)/(29.92*Tk)]^{0.5}$$

= 34.850

$$Qacfm = Qcfm[(P0*298)/(29.92*Tk)]^{-0.5}$$ = 38.848

Clean Filter Trans. 21.8

% Difference: 2.1 % (from SCFM)

% Difference: -2.9 % (from 40 ACFM)

B I S O N E N G I N E E R I N G I N C

Helena, Montana

PM-10 Auditing - Wedding Assoc.

Audited by Jack Dartman Location Livingston Railyard

Date 9/18/91 Sampler # Downwind Site

Look-up :

P1/P0 = .944 (from previous calibration)

Temperature: 283 (degrees K)

Look-up = 39.644 = Look-ACFM

Look-SCFM = 35.753 (std ft^3/min)

= ACFM[P0*298]/29.92*Tk] Tk=temp degrees K

Audit Orifice

10 " Manometer 2.85 " (Clean Filter)

$$Q = .62283\ (dP)^{.48645}$$

= 1.037 (m^3/min)

Qcfm = Q*35.314

= 36.608 (acfm)r

$$Qscfm = Qcfm[(P0*298)/(29.92*Tk)]^{0.5}$$

= 34.765

$$Qacfm = Qcfm[(P0*298)/(29.92*Tk)]^{-0.5}$$ = 38.549

Clean Filter Trans. 21.0

% Difference: 2.8 % (from SCFM)

% Difference: -3.6 % (from 40 ACFM)